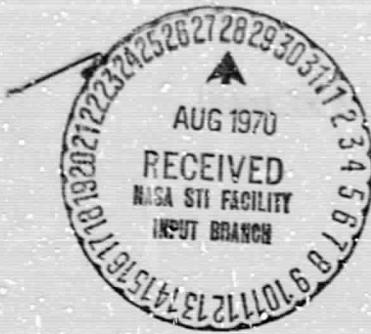


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NASA TECHNICAL  
MEMORANDUM

Report No. 53875



DETERMINATION OF MASS CHARACTERISTICS S-IC-2

By T. A. Henegar  
Quality Assurance and Reliability Laboratory

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DETERMINATION OF MASS CHARACTERISTICS

S-IC-2

By

T. A. Henegar

ABSTRACT

This report presents all the data taken by personnel of the Mechanical Analysis Branch, Analytical Operations Division, Quality and Reliability Assurance Laboratory for determining the mass characteristics and longitudinal center of gravity of the S-IC-2 Stage after static testing. These data were obtained by using a three-point compression system in accordance with procedure 6-QHSIC-AM-33A, "Determination of S-IC Stage Weight and Center of Gravity." The status of the stage at the time these data were obtained is presented.

METHODS AND RESEARCH SECTION  
MECHANICAL ANALYSIS BRANCH  
ANALYTICAL OPERATIONS DIVISION

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March 6, 1967

IN-R-QUAL-67-3

DETERMINATION OF MASS CHARACTERISTICS

S-IC-2

By

T. A. Henegar\*

SUMMARY

The weighing operations and measurements to determine the longitudinal center of gravity were completed February 17, 1967, in accordance with procedure 6-QHSIC-AM-33A, "Determination of S-IC Stage Weight and Center of Gravity." The weighing was performed with the stage in a horizontal position; position I of the stage was down. The average weight of the S-IC-2 Stage in the "as weighed" condition, not corrected for status, is 324,944 pounds. Using this weight, the "as weighed" longitudinal center of gravity was determined to be located at the 531.579 station.

The results of the weighing operations were satisfactory.

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\*This report was prepared by SPACO, Inc. for the Analytical Operations Division, Quality and Reliability Assurance Laboratory, George C. Marshall Space Flight Center, under Contract No. NAS8-20081.

## SECTION I. INTRODUCTION

The weighing of the S-IC-2 was performed on February 17, 1967, in building 4708 by personnel of the Mechanical Analysis Branch, Analytical Operations Division, Quality and Reliability Assurance Laboratory with the assistance of stage handling personnel of the Test Laboratory. These weighing operations were witnessed by personnel of the Propulsion and Vehicle Engineering Laboratory and representatives of The Boeing Company. All components subsequently removed from or installed on the stage will be weighed, and the weight will be recorded in the Weight and Balance History Log (MSFC Form 998) which was initiated immediately after the weighing of S-IC-2 by R-QUAL-AMM.

## SECTION II. DISCUSSION

A. WEIGHING AND LONGITUDINAL CENTER OF GRAVITY DETERMINATION

The two CS-17 force indicators (one 200K and one 100K) and the three Revere compression-type load cells (two 200K and one 100K) were supplied by The Boeing Company for weighing the MSFC assembled stages. The indicators provide direct digital readings to 200,000 pounds capacity in increments of 20 pounds and 100,000 pounds capacity in increments of 10 pounds, respectively.

Full range calibration of the force indicator and load cell systems was performed January 20, 1967, at the MSFC Test Laboratory's dead weight facility by representatives of The Boeing Company. The systems were calibrated in the compression mode by applying known forces in increments of 22,020 pounds on the 200K units and in increments of 11,010 pounds on the 100K unit. The maximum force applied to the 200K units was 198,180 pounds, and the maximum force applied to the 100K unit was 99,090 pounds. Several series of readings were recorded and then an average was taken of the recorded readings for each applied force. The difference in the average reading and the applied force was used to plot a calibration chart. The purpose of the full range calibration of the equipment was to assure that the system was operating properly and to provide a calibration adjustment chart for use during weight data reduction.

The CS-17 force indicator is a self-calibrating, automatic digital force indicator which has been factory adjusted to a standardization value. A standardization calibration check was made before and after each weighing operation to ascertain that the systems were functioning properly and to assure that the calibration was within the manufacturer's standardization tolerance. The maximum deviation from the factory adjusted standardization value was 50 pounds on the 200K system. There was no deviation on the 100K system. Both systems were within the specified tolerances. The no-load digital readout "zero" value was checked before and after each weighing. Before each weighing, the digital readout was adjusted until the counter indicated zero per the manufacturer's instruction book; after each weighing, the digital readout was checked and found to be within the specified  $\pm$  20 pounds. These data were recorded on the S-IC Stage Weight Measurement Data Sheet.

The environment of the weighing area was monitored during the weighing operation. A Hydrothermograph was used to obtain the relative humidity and the temperature; the barometric pressure was obtained from a mounted barometer. The temperature, humidity, and barometric pressure for each weighing operation were recorded on the S-IC Stage Weight Evaluation Data Sheet, appendix A.

The total weight of the stage includes the weights of the personnel platforms, the forward handling ring, and other configuration deviations as listed in the status. The average weight from three weighings shown on the S-IC Stage Weight Evaluation Data Sheet (appendix A) is 324,944 pounds. All three weighings were within the 0.1 percent requirement as specified in paragraph C.2.R of Quality and Reliability procedure, 6-QHSIC-AM-33A, "Determination of S-IC Stage Weight and Center of Gravity."

The "as weighed" longitudinal center of gravity, calculated in the "as weighed" condition, was located at station 531.579. The aft load cells were located at station 115.875, and the forward load cell was located at station 1545.375. The final center of gravity will be calculated by Propulsion and Vehicle Engineering Laboratory at a later date after corrections are made for the items entered on the Weight and Balance History Log.

A Weight and Balance History Log was initiated immediately after the weighing operations were completed. All items added to or removed from the stage shall be weighed, and the information shall be posted on this log. This information is to be used by Propulsion and Vehicle Engineering Laboratory for the final weight and center of gravity calculations. The Weight and Balance Log will be forwarded to Propulsion and Vehicle Engineering Laboratory when the stage is shipped to Kennedy Space Center.

After the S-IC-2 Stage was placed in the horizontal position, residual fuel was observed to be present for the length of the fuel tank, approximately 24 inches wide and 0.36 inch deep. A calculation revealed this fuel to weigh 74 pounds. Also, it was concluded that approximately 187 pounds of fuel remained in the engine systems including the eight actuators, control system, fuel propellant feed system, etc. Of this amount, it was volumetrically calculated that 19.6 pounds remained in each of the eight actuators (157 pounds) and empirically determined that approximately 10.0 pounds remained entrapped in the undrainable areas of the control system (hydraulic feed and return lines, spool valves, and filter by-pass valves). Based upon North American Aviation, Inc. letter 4158-109R1 dated January 13, 1964, "Action Item 12 from the 5th F-1 S-IC Interface Meeting" in which the report entitled "Block II, F-1 Engine Fuel Propellant Feed System Drainage Study" was transmitted to the NASA F-1 Program Office, each F-1 engine fuel propellant feed system contains approximately 2,220 cc (4.10 pounds) of residual fuel at the conclusion of vertical and/or horizontal drainage. The traps that contain this fuel are as follows:

- a. CG fuel feed line bellows
- b. Fuel high pressure duct bellows
- c. Turbopump fuel pump inlet and balance cavity
- d. Turbopump bearing lube seal cavity

The 2,200 cc per engine represent a total of 20.0 pounds for all five engines.

In conclusion, the residual fuel entrapped in the fuel tank, control systems, and engine systems represents approximately 261 pounds of residual fuel present at the time of weighing the S-IC-2 Stage.

The weighing operations were accomplished in a smooth manner, and no major difficulties were encountered. However, two minor problems arose. The first problem occurred during the preliminary stage and equipment preparation. In complying with paragraph C.I.E. of procedure 6-QHSIC-AM-33A, an interference was found between the weighing stand assembly, drawing 60B36044-1, and the crossbeam of the transporter assembly at load cell position number 3. This interference

was corrected by using a shorter bolt in the weighing stand assembly. The second problem resulted from insufficient clearance between the aft transporter and two components (HT-370-7049-79 and -80) of the stage forward handling ring. This interference was overcome by allowing the aft transporter to shift forward as the stage was lowered. Unsatisfactory Condition Reports, R-QUAL-12050 and -12051 have been issued which requested that a design review be conducted and the necessary changes be made to eliminate clearance problems for future stage weighings.

#### B. WEIGHT STATUS INFORMATION

The status of the S-IC-2 Stage was taken immediately preceding the weighing operation and was based on drawing 60B03000-9C. Mechanical and electrical status information is included in appendixes B and C, respectively. This information is based on "refurbishment" (H) and "common to all" (V) configuration design documentation, the "Indented Parts List," Vehicle 502 "H" Configuration, dated January 13, 1967, and the F-1 engine modification memorandums listed in MSFC memorandum no. R-P&VE-PA-67-M-196, "Memorandum Released Against S-IC-2 Engine Modifications (Revision No. 6)," dated February 20, 1967.

**NOTE:** Appendixes B and C were included in this report to reflect the stage configuration at the time of stage weighing and should in no way be used in determining the final configuration of the stage.

The following information is included in the mechanical status (appendix B):

- (1) Engineering orders and Propulsion and Vehicle Engineering Laboratory memorandums which have been complied with and engineering orders which have not been complied with. This information should be considered as reference, because all missing items covered by engineering orders which have not been complied with are also shown on the missing items list.
- (2) The missing items (components to the H and V configuration which were not installed at the time of weighing), supplementary items (components to the J configuration), nonflight items (components, tooling, and fixtures which are to be removed prior to launch), and retrofit installations completed are listed showing the number required and weight where this information was available.

Electrical status information (appendix C) includes a missing item and supplementary items.

SECTION III. CONCLUSIONS

No major difficulties were encountered during the weighing operation, and the weighing was completed on schedule.

## APPENDIX A - TEST DATA

## S-1C STATION WEIGHT EVALUATION DATA SHEET

STATION NR.: S-1C-502		DATE: February 28, 1967		FWD. END	APT. END	
DWT. NR.: 60B03000-9		REV.: C		POS. 1	POS. 2	POS. 3
AVERAGE WT. ***	R		94,563	115,720	114,787	
CALIBRATION ADJUSTMENT ***	S		-68	-23	-35	
ADJUSTED AVERAGE ***	T		94,495	115,697	114,752	
TARE WT. OF EQUIPMENT ADDED FOR WEIGHING PURPOSES	U		0	0	0	
NET WEIGHT	V		94,495	115,697	114,752	
TOTAL STAGE WT. *** (POS. 1 + POS. 2 + POS. 3)	W		324,944			REMARKS: ENVIRONMENT
GRAVITY CORRECTION	X		1.00000	WT. T NO. (OF)	R.H. (%)	B.P. (IN.HG.)
GRAVITY CORRECTED TOTAL ***	Y		324,944	1	76	97
				2	78	97
				3	77	97
CENTER OF GRAVITY STA. LOCATION ***	=	(POS. 1 NET WT.) (1429.500) TOTAL STAGE WT.	15.875			
CENTER OF GRAVITY: STA. LOCATION ***	=	<u>94,495</u> <u>(1429.500)</u> <u>(324,944)</u>				4b CALIBRATION ADJUSTMENT FROM CURVE PLOTTED THROUGH FULL RANGE.
CENTER OF GRAVITY STA. LOCATION ***	=	STA. <u>531.579</u>				*** AS WEIGHED CONDITION AND NOT ACCOUNTING FOR NON-FLIGHT ITEMS INSTALLED OR FLIGHT ITEMS NOT INSTALLED AT TIME OF WEIGHTING.

IN-R-QUAL-67-3

APPENDIX B

MECHANICAL STATUS  
IMMEDIATELY PRECEDING  
WEIGHING OPERATIONS

**B-1. ENGINEERING ORDERS AND P&VE MEMORANDUMS  
WHICH HAVE BEEN COMPLIED WITH**

60B03000-1C, 9C Stage Assembly

"H and V Configuration"

4-60B03000-9	16-60B03000-1	65-60B03000-1	501-60B03000-1
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E.O.'s Against Components or Sub-Assemblies of 60B03000-1C and 9C

501-60B02601-1	301-60B41015-27	308-60B51600-11	501-60B70081-3
9-60B02701-1	302-60B41015-27	309-60B51600-11	503-60B70081-3
302-60B02701-1	303-60B41015-27	310-60B51600-11	504-60B70081-3
303-60B02701-1	304-60B41015-27	501-60B51600-11	505-60B70081-1
304-60B02701-1	1-60B41020-1	503-60B51600-11	507-60B70081-1
305-60B02701-1	2-60B41020-1	301-60B51800-1	507-60B70081-3
301-60B02723-7***	301-60B41020-1	301-60B52700-25	510-60B70081-1
301-60B02738-1***	302-60B43020-15	302-60B52700-25	303-60B70082-1
501-60B04101-9	301-60B49301-201	501-60B52700-25	305-60B70082-3
501-60B18150-1	302-60B49301-199	301-60B52830-1	306-60B70082-3
1-60B25400-1	4-60B49400-1	302-60B52830-1	501-60B70082-3
301-60B25400-1	6-60B49400-1	303-60B52830-1	502-60B70082-1
302-60B25400-1	304-60B49400-1	501-60B52830-1	502-60B70082-3
501-60B25400-1	305-60B49400-1	302-60B67885-1	507-60B70082-1
303-60B25405-3***	306-60B49400-1	2-60B70000-5	503-60B70431-7
501-60B26000-3	307-60B49400-1	3-60B70000-5	301-60B70437-1
501-60B26221-1	304-60B49402-1	301-60B70000-5	302-60B70437-1
2-60B27000-3	15-60B49500-1	302-60B70000-5	501-60B70437-3
504-0B27600-3	314-60B49500-1	303-60B70000-5	1-60B70672-1
302-0B27110-1	315-60B49500-1	2-60B70061-1	301-60B70672-1
12-60B27370-1	502-60B49500-1	301-60B70061-1	501-60B70837-1
1-60B37044-1	2-60B51600-11	1-60B70081-3	3-60B70894-1
302-60B37044-1	3-60B51600-11	6-60B70081-1	301-60B70923-5
302-60B37080-3**	4-60B51600-11	10-60B70081-1*	1-60B70926-5
302-60B37150-1	301-60B51600-11	302-60B70081-1	301-60B70927-5
301-60B39950-1***	303-60B51600-11	303-60B70081-3	501-60B71544-3
1-60B40200-1***	304-60B51600-11	304-60B70081-3	301-60B84009-1
2-60B40200-1***	306-60B51600-11	306-60B70081-1	302-60B84009-1**
501-60B40200-1***	307-60B51600-11	501-60B70081-1	

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## Appendix B - Mechanical Status

Sheet 2 of 12

B-1. ENGINEERING ORDERS AND P&VE MEMORANDUMS  
WHICH HAVE BEEN COMPLETED WITH60B03000-7C Stage Assembly"J Configuration"

30-60B03000-7

E.O.'s Against Components or Sub-Assemblies of 60B03000-7C

1-60B20090-1	301-60B68411-1	504-60B70211-1	501-60B71999-41
301-60B68151-1	301-60B68415-1	504-60B70368-1	501-60B71999-43

60B03100-1, 9 Oxidizer Tank Assembly"H and V Configuration"

2-60B03100-1      8-60B03100-1

E.O.'s Against Components or Sub-Assemblies of 60B03100-1 and 9

9-60B12000-1	2-60B41010-1	1-60B51204-1	302-60B67514-1
15-60B12000-1	14-60B41010-1	301-60B67508-1	1-60B67518-1
301-60B12000-1	301-60B41010-1	301-60B67511-1	301-60B67518-1
303-60B12000-1	502-60B41011-1	1-60B67512-1	501-60B67518-1
16-60B12010-1	303-60B49100-1	301-60B67512-1	5-60B70085-3
302-60B12109-1	13-60B51200-1	502-60B67512-1	1-60B70401-1
301-60B12400-1	302-60B51200-1	1-60B67514-1	3-60B70401-1

60B03200-1, 9 Fuel Tank Assembly"H and V Configuration"

7-60B03200-1

E.O.'s Against Components or Sub-Assemblies of 60B03200-1 and 9

13-60B24000-1	7-60B24800-3	2-60B41011-7	301-60B67444-1
5-60B24733-1	301-60B24906-3	8-60B43011-1	303-60B70083-3
5-60B24733-5	302-60B24906-3	303-60B43011-1	304-60B70083-3
8-60B24733-3	2-60B41011-3		

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**B-1. ENGINEERING ORDERS AND P&VE MEMORANDUMS  
WHICH HAVE BEEN COMPLIED WITH**

**60B03300-1, 9 Intertank Assembly**

**"H and V Configuration"**

1-60B03300-1	3-60B03300-1	5-60B03300-1	13-60B03300-1
1-60B03300-9			

**E.O.'s Against Components or Sub-Assemblies of 60B03300-1 and 9**

303-60B26493-1	508-60B29800-1	1-60B49260-1	505-60B70084-1
302-60B27493-1	510-60B29800-1	302-60B49260-1	505-60B70084-3
4-60B28117-3	1-60B39200-1	305-60B49260-1	507-60B70084-1
5-60B28117-3	2-60B39200-1	501-60B49260-1	509-60B70084-1
503-60B28118-1	301-60B39200-1	301-60B49301-193	1-60B70444-3
301-60B28320-1**	504-60B39200-1	301-60B49301-195	301-60B70453-5
301-60B28320-5**	9-60B41012-1	1-60B49370-1	502-60B70457-1
501-60B28320-5	13-60B41012-1	501-60B49370-1*	1-60B70480-7
3-60B28360-1	14-60B41012-1	306-60B49509-1	301-60B70480-7
301-60B28360-1	304-60B41012-1	301-60B49512-5	302-60B70480-7
301-60B28550-1	305-60B41012-1	301-60B52400-21	301-60B70570-1
302-60B28550-1	306-60B41012-1	302-60B52400-21	304-60B71049-7*
506-60B28550-1	308-60B41012-1	1-60B67610-3	502-60B71049-7
301-60B28620-1	309-60B41012-1	301-60B67610-3	505-60B71049-7
301-60B28621-1	503-60B41C12-1**	501-60B67610-3	506-60B71049-7
301-60B28660-1	8-60B49200-3	301-60B67614-9	301-60B71104-3
301-60B28680-1	304-60B49200-3	1-60B70084-17	503-60B71104-3
301-60B28902-1	305-60B49200-3	301-60B70084-1	501-60B71206-39
301-60B28903-1	306-60B49200-3	302-60B70084-1	3-65B80149-3
1-60B29800-5	307-60B49200-3	302-60B70084-3	301-65B80149-3
301-60B29800-1	305-60B49251-3	304-60B70084-1***	502-65B80149-3
301-60B29800-5	306-60B49251-3	503-60B70084-1	503-65B80149-3
303-60B29800-1	501-60B49251-3		

**60B03300-7 Intertank Assembly**

**"J Configuration"**

2-60B03300-7

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**B-1. ENGINEERING ORDERS AND P&VE MEMORANDUMS  
WHICH HAVE BEEN COMPLIED WITH**

**60B03400-1A, 9A Forward Skirt Assembly**

**"H and V Configuration"**

2-60B03400-9	3-60B03400-9	4-60B03400-1	301-60B03400-1
3-60B03400-1			

**E.O.'s Against Components or Sub-Assemblies of 60B03400-1A and 9A**

9-60B14009-1	504-60B15835-3	305-60B51050-1	303-60B70086-19
12-60B14009-1	504-60B15835-5	306-60B51050-1	304-60B70086-15
77-60B14009-1	24-60B39000-1**	501-60B51050-1	306-60B70086-17
85-60B14009-1**	316-60B39000-1	502-60B51050-1	306-60B70086-19
88-60B14009-1	318-60B39000-1	305-60B52600-1	307-60B70086-17
89-60B14009-1	320-60B39000-1	306-60B52600-1	501-60B70086-15
95-60B14009-1**	321-60B39000-1	501-60B52600-1	501-60B70086-17
97-60B14009-1	322-60B39000-1	4-60B52800-1	501-60B70086-19
301-60B14009-1	303-60B39100-1	301-60B52800-1	503-60B70086-15
511-60B14009-1	304-60B39100-1	302-60B52800-1	503-60B70086-17
301-60B14027-1**	1-60B39300-1	304-60B52800-1	504-60B70086-15
301-60B14027-3**	1-60B39500-1**	305-60B52800-1	504-60B70086-17
301-60B14027-5**	4-60B39500-1	306-60B52800-1	504-60B70086-19
303-60B14027-5	301-60B39500-3	501-60B52800-1	505-60B70086-15
503-60B14027-1	501-60B39500-1	504-60B52800-1	505-60B70086-17
503-60B14027-3	502-60B39500-1	1-60B52817-1	506-60B70086-17
503-60B14027-5	1-60B39600-1	2-60B52819-1	507-60B70086-17
504-60B14027-5***	7-60B51000-1	1-60B52830-1	508-60B70086-17
11-60B14200-1	10-60B51000-1	2-60B67423-5	509-60B70086-19
17-60B14200-1	14-60B51000-1	2-60B67423-7	301-60B70161-1
301-60B14550-5	302-60B51000-1	502-60B70055-13	301-60B70161-3
19-60B14600-1	303-60B51000-1	501-60B70058-1	302-60B70161-1
20-60B14800-1	304-60B51000-1	301-60B70059-1	302-60B70219-3
13-60B15000-1	501-60B51000-1	301-60B70059-3	2-60B70220-1
301-60B15000-3	502-60B51000-1	L2-60B70086-17B***	2-60B70220-3
510-60B15200-1	503-60B51000-1	6-60B70086-19	301-60B70220-1
512-60B15200-1	301-60B51050-1	302-60B70086-15	301-60B70220-3
501-60B15835-7	302-60B51050-1	302-60B70086-17	502-60B70340-1
504-60B15835-1	304-60B51050-1	302-60B70086-19	502-60B70340-3

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## Appendix B - Mechanical Status

Sheet 5 of 12

**B-1, ENGINEERING ORDERS AND P&VE MEMORANDUMS  
WHICH HAVE BEEN COMPLIED WITH**

502-60B70340-5	401-60B70521-5	301-60B70747-1	401-60B71291-5
502-60B70340-7	501-60B70577-7	501-60B70747-1	501-60B71291-5
401-60B70515-5	2-60B70579-1	503-60B70747-1	1-60B71801-1
401-60B70515-9	2-60B70579-3	4-60B70786-1	1-60B71801-3
4-60B70517-5	501-60B70590-9	501-60B70952-1	1-60B71801-5
301-60B70517-5	501-60B70595-5	401-60B70959-1	1-60B71801-7
302-60B70517-5	501-60B70596-3	302-60B70969-1	2-60B71801-1
303-60B70517-5	301-60B70600-7	301-60371108-7	301-60B71801-1
401-60B70517-5	1-60B70655-1	501-60B71149-7	301-60B71801-3
1-60B70518-5	302-60B70655-1	401-60B71202-7	301-60B71801-5
302-60B70518-3	303-60B70655-1	402-60B71202-7	301-60B71801-7
302-60B70518-5	502-60B70655-1	2-60B71291-5	2-65B80016-5
303-60B70518-5	503-60B70655-1	301-60B71291-5	302-65B80021-5
401-60B70518-5	2-60B70747-1	302-60B71291-5	

60B03400-7A Forward Skirt Assembly"J Configuration"E.O.'s Against Components or Sub-Assemblies of 60B03400-7A

301-60B39960-1	8-60B70086-19	301-60B70219-3**
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60B03500-1, 9 Thrust Structure Assembly"H and V Configuration"

1-60B03500-1	6-60B03500-1	13-60B03500-1	24-60B03500-1
5-60B03500-1	10-60B03500-1	16-60B03500-1	301-60B03500-9

E.O.'s Against Components or Sub-Assemblies of 60B03500-1 and 9

512-60B16010-1	15-60B18040-9	97-60B18054-1*	574-60B18054-1
201-60B18036-1	502-60B18040-9	107-60B18054-1**	578-60B18054-1
4-60B18040-9	4-60B18054-7	314-60B18054-1	579-60B18054-1
13-60B18040-9	8-60B18054-7	502-60B18054-7	598-60B18054-1
14-60B18040-9	95-60B18054-1	543-60B18054-1	55-60B18060-1

\* WAIVED

\*\* PARTIALLY WAIVED

## Appendix B - Mechanical Status

Sheet 6 of 12

B-1. ENGINEERING ORDERS AND P&VE MEMORANDUMS  
WHICH HAVE BEEN COMPLIED WITH

57-60B18060-1	3-60B18120-3	301-60B20005-1	10-60B37601-1
59-60B18060-1	7-60B18122-8	305-60B20005-1	14-60B37601-1
61-60B18060-1	8-60B18122-5	509-60B20005-1	17-60B37601-1
64-60B18060-1	11-60B18122-4	501-60B20053-1	18-60B37601-1
59-60B18060-1	14-60B18122-1	20-60B20100-1	301-60B37601-1
342-60B18060-1	14-60B18122-6	302-60B20100-1	303-60B37601-1
343-60B18060-1	302-60B18122-1	4-60B20139-1	304-60B37601-1
344-60B18060-1	18-60B18124-1	3-60B21140-1	308-60B37601-1
346-60B18060-1	303-60B18124-3	302-60B21140-1	309-60B37601-1
348-60B18060-1	514-60B18124-1	303-60B21140-1	312-60B37601-1
351-60B18060-1***	301-60B18343-1	301-60B21151-1**	503-60B37601-1
510-60B18060-1	1-60B18513-3	301-60B21151-3**	1-60B37602-1
511-60B18060-1	301-60B18527-1	301-60B26463-1	2-60B37602-1
514-60B18060-1	23-60B18900-1	301-60B37257-1	301-60B37602-1
516-60B18060-1	27-60B18900-1	301-60B37257-3	302-60B37602-1
519-60B18060-1*	30-60B18900-1	301-60B37257-5	303-60B37602-1
520-60B18060-1	301-60B18901-1	301-60B37257-7	304-60B37602-1
532-60B18060-1	305-60B18902-1	301-60B37257-9	305-60B37602-1
5-60B18063-1	302-60B18995-1	3-60B37550-1	306-60B37602-1
7-60B18063-1	3-60B19001-1	4-60B37550-1	307-60B37602-1
10-60B18063-1**	303-60B19100-7	5-60B37550-1	308-60B37602-1
11-60B18063-1	508-60B19100-7	303-60B37550-1	309-60B37602-1
12-60B18063-1	508-60B19100-6	306-60B37550-1	501-60B37602-1
15-60B18063-1	509-60B19100-1	308-60B37550-1	301-60B37614-1
17-60B18063-1	4-60B19106-1	309-60B37550-1	301-60B37614-3
306-60B18063-1	8-60B19159-1	310-60B37550-1	301-60B37614-5
308-60B18063-1	21-60B19160-1	311-60B37550-1	301-60B37614-7
309-60B18063-1	203-60B1927-3	312-60B37550-1	301-60B37614-9
310-60B18063-1	505-60B19700-1	314-60B37550-1	501-60B37614-1
311-60B18063-1	511-60B19702-1	315-60B37550-1	501-60B37614-3
312-60B18063-1	511-60B19702-3	1-60B37600-55	501-60B37614-5
313-60B18063-1	7-60B19750-1	1-60B37600-59	501-60B37614-7
316-60B18063-1	301-60B19909-1	2-60B37600-55	501-60B37614-9
317-60B18063-1	301-60B19909-2	302-60B37600-55	2-60B37616-1
504-60B18063-1	5-60B20005-1	303-60B37600-55	2-60B37616-3
506-60B18063-1	6-60B20005-1	304-60B37600-55	2-60B37616-5
508-60B18063-1	26-60B20005-1	306-60B37600-55	2-60B37617-1
509-60B18063-1	31-60B20005-1	307-60B37600-1	2-60B37617-3
512-60B18063-1	35-60B20005-1	308-60B37600-1	3-60B37622-1
513-60B18063-1	37-60B20005-1	8-60B37601-1	3-60B37622-3

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## Appendix B - Mechanical Status

Sheet 7 of 12

B-1. ENGINEERING ORDERS AND P&VE MEMORANDUMS  
WHICH HAVE BEEN COMPLIED WITH

3-60B37622-5	308-60B41221-1	331-60B43014-3	303-60B51409-1
3-60B37622-7	309-60B41221-1	332-60B43-14-3	305-60B51409-1
3-60B37622-9	312-60B41221-1	503-60B43014-3**	307-60B51409-1
2-60B37770-1	313-60B41221-1	507-60B43014-3	2-60B51438-5
4-60B37770-1	315-60B41221-1	1-60B43065-1	3-60B51438-5
7-60B37770-1	317-60B41221-1	301-60B49301-189	301-60B51438-5
9-60B37770-1	318-60B41221-1	301-60B49,01-191	302-60B51438-5
10-60B37770-1	503-60B41221-1	301-60B49301-197	4-60B51439-1
11-60B37770-1	504-60B41221-1	301-60B49350-3	6-60B51439-1
301-60B37770-1	311-60B41223-1	303-60B49350-1	11-60B51439-1
302-60B37770-1	315-60B41223-1	301-60B49360-1	303-60B51439-1
303-60B37770-1	317-60B41223-1	302-60B49361-1	304-60B51439-1
305-60B37770-1	318-60B41223-1***	302-60B49361-3	306-60B51439-1
8-60B40000-1	3-60B43013-3	1-60B49380-1	307-60B51439-1
306-60B40000-1	4-60B43013-3	301-60B49384-1	308-60B51439-1
1-60B40100-1	5-60B43014-3	301-60B49385-1	309-60B51439-1
502-60B40100-1	6-60B43014-3	301-60B49386-1	310-60B51439-1
6-60B41014-7	7-60B43014-3**	301-60B49387-1	501-60B51472-1
7-60B41014-7	9-60B43014-3	301-60B49388-1	502-60B52320-31
8-60B41014-7	13-60B43013-3	7-60B49600-1**	1-60B52500-1
19-60B41014-7	24-60B43014-3	8-60B49600-1**	3-60B52500-1
21-60B41014-7	301-60B43014-3	12-60B49600-1	11-60B52500-1
32-60B41014-7	302-60B43014-3	18-60B49600-1	15-60B52500-1
33-60B41014-7	303-60B43014-3	308-60B49600-1	19-60B52500-1
35-60B41014-7	304-60B43014-3	323-60B49600-1	301-60B52500-1
303-60B41014-7	305-60B43014-3	326-60B49600-1	304-60B52500-1
308-60B41014-7	306-60B43014-3	502-60B49600-1	305-60B52500-1**
309-60B41014-7	307-60B43014-3	503-60B49600-1	306-60B52500-1
310-60B41014-7	309-60B43014-3	505-60B49600-1	307-60B52500-1
312-60B41014-7	311-60B43014-3	301-60B49606-1	309-60B52500-1
316-60B41014-7	314-60B43014-3	303-60B49607-1	311-60B52500-1
318-60B41014-7	315-60B43014-3	4-60B49614-1	502-60B52500-1
320-60B41014-7	316-60B43014-3	4-60B51400-1	303-60B52501-1
321-60B41014-7	317-60B43-14-3	302-60B51400-1	304-60B52501-3
323-60B41014-7	318-60B43014-3	3-60B51405-1	304-60B52501-5
324-60B41014-7	319-60B43014-3	5-60B51405-1	301-60B52506-1
503-60B41014-7	320-60B43014-3	9-60B51405-1	302-60B52506-1*
504-60B41014-7**	326-60B43014-3	301-60B51405-1	301-60B52550-1
12-60B41221-1	328-60B43014-3	303-60B51405-1	4-60B52840-1
13-60B41221-1	329-60B43014-3	302-60B51409-1	302-60B52840-1

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\*\* PARTIALLY WAIVED

**B-1. ENGINEERING ORDERS AND P&VE MEMORANDUMS  
WHICH HAVE BEEN COMPLIED WITH**

303-60B52840-1	302-60B67575-1**	302-60B70471-1	301-60B71708-1
501-60B52840-1	301-60B67885-1	1-60B70472-3	501-60B71709-1
1-60B64333-9	501-60B67992-1	5-60B70665-1**	5-60B82000-1
501-60B67006-5	501-60B67992-3	2-60B70666-1**	6-60B82000-1
1-60B67008-5	1-60B70025-5	501-60B70666-1	8-60B82000-1
302-60B67010-5	302-60B70025-5	1-60B70676-5	302-60B82000-1
1-60B67051-1	301-60B70031-3	1-60B70676-7	303-60B82000-1
501-60B67051-1	303-60B70031-1	6-60B70771-1	304-60B82000-1
2-60B67052-1	2-60B70044-5	303-60B70771-1	3-65B80013-3
3-60B67052-1	301-60B70044-5	310-60B70771-1	4-65B80013-3
302-60B67052-1	301-60B70049-5	502-60B70771-1	304-65B80013-3
303-60B67052-1	302-60B70049-5	301-60B70775-1	306-65B80013-3
304-60B67052-1	301-60B70054-5	2-60B70776-1	307-65B80013-3
305-60B67052-1	14-60B70080-1	302-60B70776-1	503-65B80013-3
1-60B67053-1	507-60B70080-1	303-60B70776-1	506-65B80013-3
301-60B67053-1	1-60B70107-1	501-60B70776-1*	507-65B80013-3
302-60B67053-1	4-60B70149-1	2-60B70782-1	508-65B80013-3
1-60B67054-17	502-60B70149-1	301-60B70782-1	2-65B80014-3
301-60B67054-17	1-60B70159-5	301-60B70783-1	5-65B80014-3
301-60B67069-1***	501-60B70322-3	301-60B70784-1	304-65B80014-3
2-60B67106-5	301-60B70327-39	301-60B70785-1	306-65B80014-3
302-60B67106-5	301-60B70327-45	301-60B70786-1	307-65B80014-3
3-60B67116-1	302-60B70327-39	301-60B70792-1	501-65B80014-3
4-60B67116-1	302-60B70327-45	501-60B70792-1	502-65B80014-3
6-60B67116-1	303-60B70327-39	502-60B70792-1	503-65B80014-3
2-60B67117-1	303-60B70327-45	1-60B70940-1	506-65B80014-3
302-60B67117-1	304-60B70327-39	301-60B70740-1	507-65B80014-3
303-60B67117-1	305-60B70327-39	501-60B70940-1	509-65B80014-3
501-60B67117-1	501-60B70327-313	301-60B70941-1	3-65B80015-7
1-60B67120-1	502-60B70327-45***	302-60B70941-1	4-65B80015-7
301-60B67123-5	503-60B70327-39	1-60B71086-5	5-65B80015-7
501-60B67123-5	301-60B70342-1	1-60B71087-5	6-65B80015-7
302-60B67125-1	301-60B70410-1	2-60B71121-5	7-65B80015-7
2-60B67134-5	301-60B70410-7	3-60B71121-5	8-65B80015-7
3-60B67134-5	1-60B70426-1	501-60B71121-5	9-65B80015-7
302-60B67134-5	2-60B70431-7	1-60B71198-5	10-65B80015-7
303-60B67134-5	301-60B70431-1	501-60B71244-1	11-65B80015-7
502-60B67134-5	301-60B70431-3	3-60B71261-1	302-65B80015-7
1-60B67137-3	501-60B70431-7	303-60B71398-1	304-65B80015-7
301-60B67137-3	502-60B70431-1	3-60B71620-1	305-65B80015-7
301-60B67575-1	301-60B70471-1	301-60B71620-1	

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**B-1. ENGINEERING ORDERS AND P&VE MEMORANDUMS  
WHICH HAVE BEEN COMPLIED WITH**

**60B03500-7 Thrust Structure Assembly**

**"J Configuration"**

1-60B03500-7      301-60B03500-7

**E.O.'s Against Components or Sub-Assemblies of 60B03500-7**

3-60B18040-11      6-60B18054-9      303-60B20005-1      19-60B20100-1

**60B37151-1C Engine Assembly 101 (F-4017)**

None

**E.O.'s Against Components or Sub-Assemblies of 60B37151-1C**

302-60B37161-17	301-60B67912-1	301-60B70848-3	301-60B70858-3
303-60B37161-17	301-60B67912-3	501-60B70848-3	301-60B71837-1
501-60B67297-1	302-60B67912-1	501-60B70850-3	1-60B71905-1
501-60B67297-3	501-60B67912-1	302-60B70851-1	1-60B71906-1
502-60B67297-1	303-60B68011-1	303-60B70851-1	2-60B83000-3**
502-60B67297-3	305-60B68011-1	501-60B70852-1	301-60B83000-3
503-60B67796-1	1-60B68162-1	301-60B70857-7	302-60B83000-3*
501-60B67841-1	301-60B70429-7	301-60B70857-9	303-60B83000-3
301-60B67845-1	302-60B70429-7	301-60B70857-11	1-60B84000-5
301-60B67860-1	301-60B70839-7	302-60B70857-7	301-60B84000-1**
301-60B67860-5	3-60B70841-3	302-60B70857-9	301-60B84000-5**
4-60B67912-3	301-60B70841-3	302-60B70857-11	302-60B84110-1

**The Following R-P&VE Memos Have Been Complied With**

65-M-518	65-M-1025	66-M-14	66-M-205
65-M-582	65-M-1072	66-M-56	66-M-250
65-M-609	65-M-1089	66-M-105	66-M-254
65-M-701	65-M-1123	66-M-112	66-M-260
65-M-705	65-M-1124	66-M-121	66-M-283
65-M-789	65-M-1131	66-M-127	66-M-289
65-M-899	65-M-1150	66-M-154	66-M-324
65-M-1017	65-M-1204	66-M-160	66-M-342
65-M-1018	65-M-1314	66-M-185	66-M-348
65-M-1019	66-M-5	66-M-193	66-M-349

**\* WAIVED**

**\*\* PARTIALLY WAIVED**

## Appendix B - Mechanical Status

Sheet 10 of 12

B-1. ENGINEERING ORDERS AND P&VE MEMORANDUMS  
WHICH HAVE BEEN COMPLIED WITH

66-M-387	66-M-654	66-M-701	66-M-783
66-M-488	66-M-656**	66-M-719	66-M-972
66-M-560	66-M-667	66-M-752	67-M-33
66-M-638	66-M-668	66-M-766	67-M-59

60B37152-1B Engine Assembly 102 (F-4018)

None

E.O.'s Against Components or Sub-Assemblies of 60B37152-1B

302-60B37162-7	304-60B67922-1	301-60B70857-9	301-60B83000-3
303-60B37162-7	305-60B67922-1	301-60B70857-11	302-60B83000-3*
301-60B67860-1	301-60B70429-7	302-60B70857-9	303-60B83000-3
301-60B67860-5	302-60B70429-7	302-60B70857-11	1-60B84000-5
2-60B67922-1	301-60B70839-7	1-60B71905-1	301-60B84000-1**
302-60B67922-1	2-60B70842-3	1-60B71906-1	301-60B84000-5**
302-60B67922-3	301-60B70842-3	2-60B83000-3**	302-60B84110-1
303-60B67922-3			

The Following R-P&VE Memos Have Been Complied With

65-M-518	65-M-1123	66-M-185	66-M-560
65-M-582	65-M-1124	66-M-193	66-M-638
65-M-609	65-M-1150	66-M-205	66-M-654
65-M-701	65-M-1204	66-M-250	66-M-656 **
65-M-705	65-M-1314	66-M-254	66-M-667
65-M-789	66-M-5	66-M-260	66-M-668
65-M-899	66-M-14	66-M-283	66-M-719
65-M-1000	66-M-56	66-M-289	66-M-752
65-M-1017	66-M-105	66-M-324	66-M-766
65-M-1018	66-M-112	66-M-342	66-M-949
65-M-1019	66-M-121	66-M-349	66-M-972
65-M-1025	66-M-127	66-M-387	67-M-33
65-M-1072	66-M-154	66-M-488	67-M-59
65-M-1089	66-M-160		

60B37153-1C Engine Assembly 103 (F-4019)

1-60B37153-1

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\*\* PARTIALLY WAIVED

## Appendix B - Mechanical Status

Sheet 11 of 12

B-1. ENGINEERING ORDERS AND P&VE MEMORANDUMS  
WHICH HAVE BEEN COMPLIED WITHE.O.'s Against Components or Sub-Assemblies of 60B37153-1C

301-50M04049-1	302-60B67932-1	501-60B70843-3	302-60B83000-3*
302-60B37163-11	302-60B68783-9	301-60B70857-9	303-60B83000-3
303-60B37163-11	301-60B70429-7	301-60B70857-11	1-60B84000-5
302-60B67783-9	302-60B70429-7	302-60B70857-9	301-60B84000-1**
301-60B67860-1	301-60B70839-5	302-60B70857-11	301-60B84000-5**
301-60B67860-5	1-60B70843-3	2-60B83000-3**	302-60B84110-1
301-60B67932-1	301-60B70843-3	301-60B83000-3	

The Following R-P&VE Memos Have Been Complied with (F-4019)

65-M-518	65-M-1123	66-M-160	66-M-560
65-M-582	65-M-1124	66-M-185	66-M-638
65-M-609	65-M-1150	66-M-193	66-M-641
65-M-701	65-M-1204	66-M-205	66-M-654
65-M-705	65-M-1314	66-M-250	66-M-656**
65-M-789	66-M-5	66-M-254	66-M-667
65-M-899	66-M-14	66-M-260	66-M-668
65-M-1017	66-M-56	66-M-283	66-M-719
65-M-1018	66-M-105	66-M-289	66-M-752
65-M-1019	66-M-112	66-M-324	66-M-766
65-M-1025	66-M-121	66-M-342	66-M-972
65-M-1072	66-M-127	66-M-349	67-M-33
65-M-1089	66-M-154	66-M-488	67-M-59

60B37154-1B Engine Assembly 104 (F-4021)

None

E.O.'s Against Components or Sub-Assemblies of 60B37154-1B

301-50M04049-1	301-60B67942-1	301-60B70857-9	302-60B83000-3*
302-60B37164-7	302-60B67942-1	301-60B70857-11	303-60B83000-3
303-60B37164-7	302-60B68784-9	302-60B70857-9	1-60B84000-5
302-60B67784-9	301-60B70429-7	302-60B70857-11	301-60B84000-1**
301-60B67860-1	302-60B70429-7	2-60B83000-3**	301-60B84000-5**
301-60B67860-5	301-60B70839-5	301-60B83000-3	302-60B84110-1
2-60B67942-1	301-60B70844-3		

\* WAIVED

\*\* PARTIALLY WAIVED

**B-1. ENGINEERING ORDERS AND P&VE MEMORANDUMS  
WHICH HAVE BEEN COMPLIED WITH**

**The Following R-P&VE Memos Have Been Complied With**

65-M-518	65-M-1123	66-M-160	66-M-488
65-M-582	65-M-1124	66-M-185	66-M-560
65-M-609	65-M-1150	66-M-193	66-M-638
65-M-701	65-M-1204	66-M-205	66-M-641
65-M-705	65-M-1314	66-M-289	66-M-656**
65-M-789	66-M-5	66-M-250	66-M-667
65-M-899	66-M-14	66-M-254	66-M-719
65-M-1017	66-M-56	66-M-260	66-M-752
65-M-1018	66-M-105	66-M-283	66-M-766
65-M-1019	66-M-112	66-M-324	66-M-972
65-M-1025	66-M-121	66-M-342	67-M-33
65-M-1072	66-M-127	66-M-349	67-M-59
65-M-1089	66-M-154	66-M-387	

**60B37155-1C Engine Assembly (F-4020)**

None

**E.O.'s Against Components or Sub-Assemblies of 60B37155-1C**

5-60B37165-11	301-60B67860-5	302-60B70429-7	302-60B70857-9
302-60B37165-11	1-60B67952-1	301-60B70839-5	302-60B70857-11
303-60B37165-11	1-60B68162-1	301-60B70857-9	301-60B70908-3
301-60B67860-1	301-60B70429-7	301-60B70857-11	301-60B71251-1

**The Following R-P&VE Memos Have Been Complied With**

65-M-518	65-M-1124	66-M-160	66-M-488
65-M-582	65-M-1150	66-M-193	66-M-560
65-M-609	65-M-1204	66-M-205	66-M-638
65-M-701	65-M-1314	66-M-250	66-M-641
65-M-705	66-M-5	66-M-254	66-M-656**
65-M-789	66-M-14	66-M-260	66-M-667
65-M-899	66-M-56	66-M-283	66-M-719
65-M-1017	66-M-105	66-M-289	66-M-752
65-M-1018	66-M-112	66-M-324	66-M-766
65-M-1019	66-M-121	66-M-342	66-M-972
65-M-1025	66-M-127	66-M-349	67-M-33
65-M-1072	66-M-154	66-M-387	67-M-59
65-M-1123			

\* WAIVED

\*\* PARTIALLY WAIVED

## Appendix B - Mechanical Status

Sheet 1 of 5

**B-2. ENGINEERING ORDERS AND P&VE MEMORANDUMS WHICH HAVE  
NOT BEEN COMPLIED WITH  
"H" and "V" Configuration**

*662*

E.O. NR.	CODE	DESCRIPTION
<u>Stage</u>		
5-10M15001		Add United States Flag to Saturn V Vehicle.
506-60B02650-1		<del>Add paint and marking patterns.</del> <i>662</i>
14-60B03000-9		Replace fasteners on Stage Assembly environmental protection.
71-60B03000-1	P-011 P-012	Maintain a positive pressure of $30 \pm 2.0$ PSIG inside the LOX and fuel tank any time the containers are sealed off from atmospheric conditions (this requirement maintained to date effective until flight).
3-60B04101-9		<del>Install 60B71018-1 Panel Assembly.</del> <i>662</i>
3-60B21334-		Change dimensions and replace hardware on insulation installation.
<u>Fuel Tank</u>		
501-60B03200-1	P-011	Maintain 60% relative humidity control (requirement accepted as of to date; however, humidity control must be maintained until flight).
4-60B24500-1		<del>Change fasteners and add lockwire requirements to cover assembly.</del> <i>662</i>
<u>Forward Skirt</u>		
3-60B70224-1		Remove optical bundle when Stage is in horizontal position or when in shipment (requirements satisfactory to date).
3-60B70226-		Remove optical bundle when Stage is in horizontal position or when in shipment (requirements satisfactory to date).
<u>Thrust Structure</u>		
1 60B03500-6		Modify fairing heat shield support structure.

**B-2. ENGINEERING ORDERS AND P&VE MEMORANDUMS WHICH HAVE NOT  
BEEN COMPLIED WITH  
"H" and "V" Configuration**

*C&J*

E.O. NR.	CODE	DESCRIPTION
8-60B03500-9		Remove panel installation 60B20700-9 and replace with 30B20506-3 installation.
10-60B18054-7		<del>Add hardware to facilitate installation of air scoop.</del> C&J
11-60B18054-1		<del>Add hardware to facilitate installation of air scoop.</del> C&J
9-60B20500-5		Add sealant RMS-5-33 around curtain edges to prevent air leakage on curtain installation.
10-60B20500-3		Apply sealant RMS-5-33 around curtain edges to prevent air leakage on curtain installation.
11-60B20500-5		<del>Replace hardware to eliminate interference on base heat shield curtain installation.</del> C&J
12-60B20500-3		<del>Replace hardware to eliminate interference on base heat shield curtain installation.</del> C&J
1-60B20506-3		Add additional support for T.V. camera installation.
2-60B20506-3		Remove Panel Assemblies 60B20406-1 and -2. Replace with Panel Assemblies 60B20350-1 and 60B20352-1 to accommodate revised liftoff switch roller pad.
301-60B20506-3		Replace fasteners on panel installation.
2-60B21140-1		Replace fasteners on panel installation.
2-60B21145-1		Add washers AN960PD1216L to control tolerance on fitting installation.
501-60B21145-1		Replace washers MS20012-26 with MS20012-12 to control grip length on fitting installation.
43-60B43014-3	P-011	Remove tube assembly end bracket and change hardware on fuel delivery system installation.

## Appendix B - Mechanical Status

Sheet 3 of 5

**B-2. ENGINEERING ORDERS AND P&VE MEMORANDUMS WHICH HAVE  
NOT BEEN COMPLIED WITH  
"H" and "V" Configuration**

E.O. NR.	CODE	DESCRIPTION
301-60B70473-3		Rotate and add zone box to prevent interference with tubing on zone box installation.
504-65B80013-3		Remove Plug 65B8011-1 from flight plate on umbilical plate installation.
512-65B80013-3		Add lockwire to umbilical plate installation.  <u>The Following R-P&amp;VE Memorandums Have Not Been Complied With</u>
		<u>60B37151-1C Engine Assembly (F-4017)</u>
66-M-610		Incorporation of High Voltage Ignitors (KSC) before firing.
66-M-617		Identification of F-1 Engine components to field configuration.
66-M-777		Re-identification of F-1 Thrust Chamber.
66-M-840		<del>Return of thrust O.K. pressure switches for vibration tests. 86t.</del>
66-M-1154		Revised modification instruction for engine electrical cable support post (revised torque requirements).
67-M-142		Rerouting of S-IC-2 Engine calorimeter purge lines.
67-M-199		Incorporation of the redundant engine shut-down system.
		<u>60B37152-1B Engine Assembly (F-4018)</u>
66-M-610		Incorporation of high voltage ignitors (KSC) before firing.
66-M-617		Identification of F-1 Engine components to field configuration.
66-M-777		Re-identification of F-1 Thrust Chamber.

## Appendix B - Mechanical Status

Sheet 4 of 5

**B-2. ENGINEERING ORDERS AND P&VE MEMORANDUMS WHICH HAVE NOT  
BEEN COMPLIED WITH  
"H" and "V" Configuration**

E.O. NR.	CODE	DESCRIPTION
66-M-840		<del>Return of thrust O.K. pressure switches for vibration tests.</del> C&T
66-M-1154		Revised modification instruction for engine electrical cable support post (revised torque requirements).
67-M-199		Incorporation of the redundant engine shut-down system. <u>60B37153-1C Engine Assembly (F-4019)</u>
66-M-610		Incorporation of high voltage ignitors (KSC) before firing.
66-M-617		Identification of F-1 Engine components to field configuration.
66-M-777		Re-identification of F-1 Thrust Chamber.
66-M-840		<del>Return of thrust O.K. pressure switches for vibration tests.</del> C&T
66-M-1154		Revised modification instruction for engine electrical cable support post (revised torque requirements).
67-M-199		Incorporation of the redundant engine shut-down system. <u>60B37154-1B Engine Assembly (F-4021)</u>
66-M-610		Incorporation of high voltage ignitors (KSC) before firing.
66-M-617		Identification of F-1 Engine components to field configuration.
66-M-777		Re-identification of F-1 Thrust Chamber.
66-M-840		<del>Return of thrust O.K. pressure switches for vibration tests.</del> C&T

## Appendix B - Mechanical Status

Sheet 5 of 5

**B-2. ENGINEERING ORDERS AND P&VE MEMORANDUMS WHICH HAVE NOT  
BEEN COMPLIED WITH  
"H" and "V" Configuration**

E.O. NR.	CODE	DESCRIPTION
66-M-1154		Revised modification instruction for engine electrical cable support post (revised torque requirements).
67-M-199		Incorporation of the redundant engine shut-down system. <u>60B37155-1G Engine Assembly (F-4020)</u>
66-M-610		Incorporation of high voltage ignitors (KSC) before firing.
66-M-617		Identification of F-1 engine components to field configuration.
66-M-777		Re-identification of F-1 Thrust Chamber.
66-M-840		<del>Return of thrust O.K. pressure switch for vibration tests. Gt</del>
67-M-142		Re-routing of 3-IG-2 engine calorimeter purge lines.
67-M-199		Incorporation of the redundant engine shut-down system.

## WEIGHT STATUS SHEET

B-3. Missing Item - (H&amp;V Configuration)

SCP for HPC

Part Number	Description	Number Req'd	Unit Weight	Total Weight
	Stage Assembly 60B03000			
	NONE			
	Oxidizer Tank Assembly 60B03100			
	NONE			
	Fuel Tank Assembly 60B03200			
	NONE			
	Intertank Assembly 60B03300			
	NONE			
	Forward Skirt Assembly 60B03400			
	NONE			
	Thrust Structure 60B03500			
60B20223-1	Washer, Eng. Heat Shield	104		
60B20350-1	Panel Assembly	1		
60B20352-1	Panel Assembly	2		
60B20410-1	Panel Assembly	1		
60B20410-2	Panel Assembly	1		
60B20451-1	Radius Filler, Base Heat Shield	3		
60B21006-1	Panel Assembly, Eng. Heat Shield	2		

**WEIGHT STATUS SHEET**

### B-3. Missing Items - (H&V Configuration)

Part Number	Description	Number Req'd	Unit Weight	Total Weight
60B21006-2	Panel Assembly, Eng. Heat Shield	2		
60B21007-1	Panel Assembly, Eng. Heat Shield	2		
60B21007-2	Panel Assembly, Eng. Heat Shield	2		
60B21139-1	Filler, Eng. Heat Shield	4		
60B21142-1	Spacer, Eng. Heat Shield	4		
60B21144-1	Filler, Eng. Heat Shield	20		
60B21146-1	Fitting, Eng. Heat Shield	2		
60B21146-2	Fitting, Eng. Heat Shield	2		
60B21149-1	Bearing Assy., Eng. Heat Shield	8		
60B21314-1	Bearing Assy., Eng. Heat Shield	2		
60B21314-2	Bearing Assy., Eng. Heat Shield	2		
60B21316-1	Doubler, Eng. Heat Shield	2		
60B21317-1	Fitting, Eng. Heat Shield	2		
60B21331-1	Insulation Assembly, Outrigger	2		
60B21331-2	Insulation Assembly, Outrigger	2		
60B21332-1	Insulation Assembly, Outrigger	2		
60B21333-1	Insulation Assembly, Outrigger	2		
60B21333-2	Insulation Assembly, Outrigger	2		
60B64239-1	Cover Plate, Cannon Plug Mount	1		

**WEIGHT STATUS SHEET**

B-4. Supplementary Items - (Installed to J Configuration)

Part Number	Description	Number Req'd	Unit Weight	Total Weight
	Forward Skirt Assembly 60B03400			
60B70267-1	Clip Ring Frame	2		
60B70267-2	Clip Ring Frame	2		
60B70267-3	Clip Ring Frame	2		
60B70267-4	Clip Ring Frame	2		
60B70267-5	Clip Ring Frame	2		
60B70267-6	Clip Ring Frame	2		
60B70563-1	Adapter Ring	1		
60B70564-1	Adapter Ring	2		
60B70554-1	Gasket	1		
60B70681-1	Gasket	1		
60B70681-3	Gasket	1		
60B70681-5	Gasket	1		
60B70681-7	Gasket	1		
60B70681-9	Gasket	1		
60B70681-11	Gasket	2		
60B70681-13	Gasket	2		
60B79610-1	Flash Head	1		
60B79610-3	Flash Head	1		

**WEIGHT STATUS SHEET**

#### B-4. Supplementary Items - (Installed to J Configuration)

## WEIGHT STATUS SHEET

B-4. Supplementary Items - (Installed to J Configuration)

Part Number	Description	Number Req'd	Unit Weight	Total Weight
	ENGINES			
145188	Bracket Assy., Eng. Insulation	5		
145255	Clamp, Eng. Insulation	10		
145286	Bracket Assy., Eng. Insulation	5		
145290	Bracket Assy., Eng. Insulation	5		
145304	Bracket Assy., Eng. Insulation	5		
145305	Tie Rod Assy., Eng. Insulation	5		
145324	Support Assy., Eng. Insulation	5		
145325	Frame Assy., Eng. Insulation	5		
145344	Bracket Assy., Eng. Insulation	5		
145352	Bracket Assy., Eng. Insulation	5		
145354	Bracket Assy., Eng. Insulation	5		
145355	Bracket Assy., Eng. Insulation	5		
145369-11	Insulator Assy., Eng. Insulation	5		
145370-11	Insulator Assy., Eng. Insulation	5		
145371	Insulator Assy., Eng. Insulation	5		
145372	Insulator Assy., Eng. Insulation	5		
145380	Insulator Assy., Eng. Insulation	5		
145381	Insulator Assy., Eng. Insulation	5		
145382	Insulator Assy., Eng. Insulation	5		
145383	Insulator Assy., Eng. Insulation	5		
145384	Insulator Assy., Eng. Insulation	5		

## WEIGHT STATUS SHEET

B-4. Supplementary Items - (Installed to J Configuration)

Part Number	Description	Number Req'd	Unit Height	Total Weight
ENGINES (Continued)				
145385	Insulator Assy., Eng. Insulation	5		
145408	Stiffener Assy., Eng. Insulation	5		
145423	Stiffener Assy., Eng. Insulation	5		
145432-2	Plate, Eng. Insulation	5		
145445	Collar, Eng. Insulation	5		
145446	Bracket, Eng. Insulation	5		
145447	Bracket, Eng. Insulation	10		
145454	Bracket Assy., Eng. Insulation	5		
145471-2	Bracket Assy., Eng. Insulation	5		
145477	Frame Assy., Eng. Insulation	5		
145489	Bracket, Eng. Insulation	5		
145490	Bracket Assy., Eng. Insulation	5		
145491	Strut Assy., Eng. Insulation	5		
145493	Saddle, Eng. Insulation	5		
145496	Support Assy., Eng. Insulation	5		
145497	Frame Assy., Eng. Insulation	5		
145498	Frame Assy., Eng. Insulation	5		
145499	Bow Assy., Eng. Insulation	5		
145532	Insulator Assy., Eng. Insulation	5		
145601	Bracket Assy., Eng. Insulation	5		
145614	Bracket Assy., Eng. Insulation	5		

WEIGHT STATUS SHEET

B-4. Supplementary Items - (Installed to J Configuration)

WEIGHT STATUS SHEET

B-5. Nonflight Items Installed - Stage Assembly

## WEIGHT STATUS SHEET

B-5. Nonflight Items Installed - Stage Assembly

Part Number	Description	Number Req'd	Unit Weight	Total Weight
	Thrust Structure 60B3500 (Cont.)			
65B61001-1	Fitting Assy., Station 280	1		
65B61003-1	Fitting Assy.	1		
65B61003-3	Fitting Assy.	1		
65B61005-1	Filler Web	2		
65B61006-1	Fitting Assy., Station '80	1		
65B61006-2	Fitting Assy., Station 280	1		
65B61007-1	Ftg. Stage Weighing	1		
65B61007-2	Ftg. Stage Weighing	1		
65B61008-1	Channel backup	4		
65B61009-1	Channel backup	1		
65B61009-2	Channel backup	1		
65B61010-1	Channel backup	2		
65B61010-2	Channel backup	2		
65B61011-1	Channel backup	4		
65B61012-1	Channel backup	2		
65B61013-1	Channel backup	1		
65B61013-2	Channel backup	1		
65B61014-1	Web Filler	4		
65B61015-1	Web Filler	4		
65B61017-1	Shim Doubler Repl.	1		

## WEIGHT STATUS SHEET

## B-5. Nonflight Items Installed - Stage Assembly

Part Number	Description	Number Req'd	Unit Weight	Total Weight
	Thrust Structure 60BC3500 (Cont.)			
65B61018-1	Filler Weight Pad	1		
65B61018-2	Filler Weight Pad	1		
65B61023-1	Channel backup	2		
65B61024-1	Channel backup	2		
65B61028-1	Fitting Assembly	1		
65B61028-3	Fitting Assembly	2		
65B61028-5	Fitting Assembly	1		
65B61030-1	Filler Web	2		
65B61045-1	Fitting (Manual Actuators)	4		
65B61085-1	Shim Assy., Doubler Repl.	1		
65B61085-5	Shim Assy., Doubler Repl.	1		
65B64060-1	Protective Plugs, Retro-Rockets	16		
65B64061-1	Protective Cap, Retro-Rockets	16		
65B64062-1	Protective Cap, Retro-Rockets	16		
65B80065-1	Umbilical Carrier #2 (with fittings)	1		
65B80358-3	Cover Assembly, LOX Suction Line Drain	1		
65B80358-3	Cover, Fuel Fill and Drain	1		
RX20700	Thrust Chamber Plug (Eng.)	5		
RX20841	Hyergol Plug	5		
	Tape, Foam	5		
131-13489	Actuator Locks (MOOG)	5		

**WEIGHT STATUS SHEET**

B-5. Nonflight Items Installed - Stage Assembly

## WEIGHT STATUS SHEET

## B-6. RETROFIT INSTALLATIONS COMPLETED

Part Number	Description	Qty. Inst.	Unit Weight	Total Weight
60B37105-1	Retrofit Installation, Regulator	1		
	Engine LOX Seal Purge			
60B39960-1	Retrofit Installation, Gas Detection System, Forward Skirt	1		
60B39960-3	Retrofit Installation, Gas Detection System, Thrust Structure	1		
60B51950-1	Retrofit Installation, Check Valve	1		
60B51950-3	Retrofit Installation, Check Valve	1		
60B67283-1	Retrofit Installation, Power Divider	1		
60B67463-1	Retrofit Installation, Hybrid Ring	1		
60B67472-1	Retrofit Installation, Temperature Measurement C213-120	1		
60B67476-3	Retrofit Installation, Temperature Measurement C215-120	1		
60B67476-5	Retrofit Installation, Temperature Measurement C217-120	1		
60B67477-1	Retrofit Installation, Measurements, Temperature and Pressure C214-120	1		

**WEIGHT STATUS SHEET**

#### B-6. RETROFIT INSTALLATIONS COMPLETED

APPENDIX C

ELECTRICAL STATUS  
IMMEDIATELY PRECEDING  
WEIGHING OPERATIONS

## Appendix C - Electrical Status

**WEIGHT STATUS SHEET**

**C-1. Missing Item - (H&V Configuration)**

## Appendix C - Electrical Status

## WEIGHT STATUS SHEET

## C-2. Supplementary Items (Installed to J Configuration)

Part Number	Description	Number Req'd	Unit Weight	Total Weight
60B55702-1A	Cable Assembly - 115W304	1		
60B55703-1A	Cable Assembly - 115W305	1		
60B55704-1A	Cable Assembly - 115W306	1		
60B55705-1A	Cable Assembly - 115W307	1		
60B55706-1A	Cable Assembly - 115W308	1		
60B55707-1A	Cable Assembly - 115W309	1		
60B55711-1A	Cable Assembly - 115W313	1		
60B55935-1A	Cable Assembly - 115W215	1		
60B56005-1A	Cable Assembly - 115W295	1		
60B67608-1	Zone Box Assembly	9		
60B67608-3	Zone Box Assembly	2		
60B71141-9B	Sensor Assembly	2		
60B71141-13B	Sensor Assembly	5		
60B72063-1A	Calorimeter	2		
60B72065-1A	Calorimeter	2		
60B72199-3A	Pressure Transducer	4		
60B72201-1A	Pressure Transducer	1		
60B72206-1A	Separation Transducer	3		
60B79610-1C	Narrow Angle Light Assembly	1		
60B79610-3C	Wide Angle Light Assembly	1		
60B79610-7C	High Voltage Cable	2		

March 6, 1967

IN-R-QUAL-67-3

APPROVAL

DETERMINATION OF MASS CHARACTERISTICS

S-IC-2

The information in this report has been reviewed for security classification. Review of any information concerning Department of Defense or Atomic Energy Commission programs has been made by the MSFC Security Classification Officer. This report, in its entirety, has been determined to be unclassified.

This document has also been reviewed and approved for technical accuracy.

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